PATENT ABSTRACTS OF JAPAN

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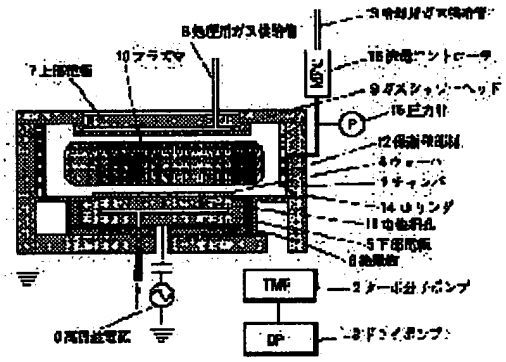
(54) PLASMA PROCESSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To facilitate the work of cleaning the inside of a plasma processor, and also, stabilize the condition of temperature within the device.

SOLUTION: A plasma processor is equipped with a chamber 1 where a wafer 4 to be the target of processing is stored, a turbo molecular pump 2 and a dry pump 3 which exhaust the internal air of the chamber 1, and a pair of a lower electrode 5 and an upper electrode 7 which perform the desired processing by making the processing gas introduced into the chamber 1 into plasma and applying it to the wafer 4. A protective wall member 12 is attached exchangeably through specified space along the inwall of the chamber 1 so as to facilitate the cleaning work. Moreover, the plasma processing is stabilized by introducing cooling gas into the space through a gas supply pipe 13, thereby suppressing the temperature rice at the surface of the protective wall member 12 caused by the heat generated within the chamber 1.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to plasma treatment equipment. It is related with the cooling structure of protection wall material prepared in the interior of the chamber of plasma treatment equipment in more detail.
[0002]
[Description of the Prior Art] Generally, plasma treatment equipment is equipped with the chamber in which the substrate used as a processing object is stored, the pump which exhausts the interior of this chamber, and an electrode means to plasma-ize the gas for processing introduced into the interior of this chamber, to irradiate a substrate, and to process a request. The plasma treatment equipment which has this structure is used abundantly in the semiconductor process etc. For example, it is used for etching processing of the silicon oxide formed on the silicon wafer. Plasma is irradiated by using as a mask the photoresist by which patterning was carried out, it **********s alternatively and a silicon oxide is removed. In this case, plasma treatment equipment equipped with parallel monotonous type electrode structure is used. In etching processing of a silicon oxide, in order to secure selectivity with the silicon layer of a ground, CHF3, CF4, and C4F8 grade are chosen as gas for processing. These gas for processing generates the polymer expressed with CxFy in the process of plasma-izing.
[0003]
[Problem(s) to be Solved by the Invention] This polymer adheres to all the places in a vacuum housing including the wall surface of a chamber as the etching processing number of sheets of a wafer increases. If the thickness of the polymer adhering to this wall surface increases in proportion to the processing number of sheets of a wafer and reaches a certain thickness, it will exfoliate from a wall surface and will cause dust generating. For this reason, you have to remove the polymer adhering to the wall surface for every predetermined wafer processing number of sheets. Now, in the mass-production process of a semiconductor, the removal work of this polymer is needed every several days. Increase of the working hours spent on this chamber cleaning has the technical problem that it leads to the fall of productivity.
[0004]
[Means for Solving the Problem] The following meanses were provided in order to solve the technical problem of a Prior art mentioned above. That is, the plasma treatment equipment concerning this invention is equipped with the chamber in which the substrate used as a processing object is stored as fundamental composition, the pump which exhausts the interior of this chamber, and an electrode means to plasma-ize the gas for processing introduced into the interior of this chamber, to irradiate this substrate, and to process a request. Protection wall material and the cooling means are established as a feature matter. The aforementioned protection wall material is attached possible [exchange] through the predetermined opening along with the wall of this chamber. The aforementioned cooling means suppresses skin-temperature elevation of the protection wall material resulting from the heat which introduced the gas for cooling into this opening, and was generated in this chamber. Preferably, the aforementioned cooling means introduces the gas for cooling chosen from helium, an argon, nitrogen,

and oxygen. Moreover, the aforementioned protection wall material consists of insulating matter which consists of a quartz or a ceramic preferably. Or the aforementioned protection wall material may consist of conductive matter chosen from silicon, a silicon carbide, carbon, and the aluminum containing alloy. The aforementioned electrode means is an parallel monotonous type containing the lower electrode which lays this substrate, and the up electrode which carried out opposite arrangement at this still more preferably. This up electrode is attached possible [exchange] through the predetermined opening along with the heavens upper wall of this chamber, and the aforementioned cooling means introduces the gas for cooling also into this opening.

[0005] According to this invention, protection wall material (the 2nd wall) is installed along with the wall (the 1st wall) of a chamber. Even if polymer deposits on the front face of this 2nd wall, the polymer in a chamber is easily removable by exchanging the 2nd wall. According to this structure, the working hours of chamber cleaning can shorten sharply. By the way, the opening exists between the 1st outside wall and the 2nd inside wall. Temporarily, if this opening is kept being the same as that of the interior of a chamber in the high-vacuum state, heat transfer between the 1st wall and the 2nd wall will be checked. The heat generated inside the chamber is accumulated on the front face of the 2nd wall, and a temperature rise is caused as the processing number of sheets of a substrate increases. Change of a process arises with this skin-temperature elevation. In order to prevent this, in this invention, skin-temperature elevation of the protection wall material resulting from the heat which introduced the gas for cooling into the opening between the 1st wall and the 2nd wall, and was generated in the chamber is suppressed. Thereby, the stability of plasma treatment is securable.

[0006]

[Embodiments of the Invention] With reference to a drawing, the optimal operation gestalt of this invention is explained in detail below. Drawing 1 is the ** type view showing the whole plasma treatment equipment composition concerning this invention. This plasma treatment equipment is equipped with the chamber 1 made from the aluminum containing alloy as a vacuum housing. This chamber 1 is exhausted with a turbo molecular pump (TMP) 2 and the dry pump (DP) 3, and can hold the interior to the vacuum of about 13-270 [Pa]. Here, the wafer 4 which consists of silicon is laid on the lower electrode 5 made in the aluminum containing alloy as a substrate used as a processing object. The lower electrode 5 is insulated electrically [a chamber 1] with the insulators 6, such as a ceramic. Moreover, the RF (for example, 13.56MHz) is impressed to the lower electrode 5 by RF generator 0. On the other hand, the up electrode 7 is installed so that it may counter with a wafer 4. As the quality of the material of the up electrode 7, although it changes with contents of a process, such as etching, carbon, silicon, an aluminum containing alloy, etc. are usually used. Besides, electrically, the section electrode 7 is grounded with a chamber 1 and this potential. The gas for processing is supplied from the gas supply pipe 8, and is introduced in a chamber 1 from the hole of a large number which carried out opening to the front face of the gas shower head 9 with which the front face of the up electrode 7 was equipped. In a chamber 1, plasma 10 occurs according to the interaction of the RF and the gas for processing which were impressed to the lower electrode 5. By irradiating this plasma 10 on the front face of a wafer 4, etching etc. processes a request. In order to prevent the temperature rise of a wafer 4 by the ion bombardment from plasma 10 etc., the gas for cooling is introduced from the electrode pore 11 prepared in the lower electrode 5 located in the rear-face side of a wafer 4. As this gas for wafer cooling, helium (helium) is usually introduced.

[0007] Inside a chamber 1, it is installing possible [exchange of the cylinder-like protection wall material 12]. The gas for wall surface cooling is introduced into the opening which exists between the 1st near wall of a chamber 1, and the 2nd near wall of the protection wall material 12 from the gas supply pipe 13 for cooling. O ring 14 is interposed in the opening in order to make high the pressure of the gas for cooling introduced into this opening compared with the inside of a chamber and to prevent defluxion to the chamber of the gas for wall surface cooling. Furthermore, the pressure gage (P) 15 and the flow controller (MFC) 16 are formed in order to control uniformly the pressure of the gas for wall surface cooling in the opening between the 1st wall and the 2nd wall. What is necessary is just to use the best helium (helium) of thermal conductivity as gas for wall surface cooling.